

The embodiments of the invention in which an exclusive property or privilege is claimed are defined on follows:

1. A method of tracing the activity of an expression, said method comprising the steps of:
 - (a) specifying a machine-implemented process in which a trigger expression is to be traced;
 - (b) specifying the trigger expression to be traced in the machine-implemented process;
 - (c) storing the state of the trigger expression when it is active within the machine-implemented process without interrupting the process; and
 - (d) restoring the state of the trigger expression when requested.
2. The method of claim 1, further comprising:
 - (a) imposing a condition onto the trigger expression; and
 - (b) storing the state of the trigger expression only when the condition is satisfied.
3. The method of claim 1, wherein the step of storing the state of the trigger expression further comprises:
 - (a) creating a history of the trigger expression comprising storing each state of the trigger expression when it is active.
4. The method of claim 3, further comprising:
 - (a) displaying the history such that the state of the trigger expression each time the trigger expression was active can be displayed separately.
5. The method of claim 1, wherein the trigger expression is one which results in an L value during the machine-implemented process.
6. The method of claim 5, wherein the activity is a call to a memory location of the trigger expression.

1 7. The method of claim 6, wherein the call to a memory location is a Read and/or a Write.

1 8. The method of claim 1, further comprising:

- 2 (a) specifying at least one attached expression;
- 3 (b) storing the state of the at least one attached expression when the trigger expression
- 4 is active within the machine-implemented process; and
- 5 (c) restoring the state of the at least one attached expression when requested.

1 9. The method of claim 1, wherein the machine-implemented process is a computer program.

1 10. The method of claim 1, as included in an object level trace program.

1 11. The method of claim 1, as included in a debug program.

1 12. A method of tracing the activity of an expression in an executing computer program, said method comprising the steps of:

- 2 (a) specifying the computer program in which a trigger expression resulting in an L value
- 3 during the execution of the computer program is to be traced;
- 4 (b) specifying the trigger expression and any optional attachment expressions to be
- 5 traced in the computer program;
- 6 (c) imposing a condition onto the trigger expression;
- 7 (d) storing the state of the trigger expression and any optional attachment expressions
- 8 when the computer program has accessed a location in memory pertaining to the
- 9 trigger expression and the conditions are satisfied to create a snapshot, the step of
- 10 storing accomplished without interrupting the process;
- 11 (e) creating a profile of the trigger expression comprising storing each snapshot;
- 12 (f) displaying the profile such that each snapshot can be displayed separately; and
- 13 (g) restoring the state of each snapshot, when requested.
- 14

- 1 13. A tracing device, comprising:
- 2 (a) a memory functionally connected to the digital logic device capable of executing a
- 3 sequence of instructions;
- 4 (b) a program to monitor the activity of an expression during the execution of the
- 5 sequence of instructions;
- 6 (c) a snapshot of the state of the expression every time the expression is active during
- 7 the execution of the sequence of instructions;
- 8 (d) a history stored in the memory, the history being a plurality of snapshots;
- 9 (e) a state restorer which restores the state of the expression in a snapshot;
- 10 (f) a user interface by which a user may interact with the program, a snapshot, and the
- 11 history.
14. The tracing device of claim 13 as incorporated into an debug program to debug the sequence of instructions.
15. The tracing device of claim 13 as incorporated into an object trace program.
16. The tracing device of claim 13, further comprising an attachment expression profiler which stores the state at least one attachment expression with each snapshot.
17. The tracing device of claim 13, wherein the tracing device and the digital logic device are incorporated into the same computer.
18. The tracing device of claim 13, wherein the tracing device and the digital logic device are separate units connected by a data communications link.

1 19. A processing device to trace the activity of an expression in a computer device, said
2 processing device, comprising:

- 3 (a) a processor;
4 (b) a memory functionally connected to the processor;
5 (c) a first computer program executing by the processor in which the expression is
6 active;
7 (d) a second computer program to trace the activity of the expression within the memory
8 during the execution of first computer program;
9 (e) a snapshot which stores the state expression every time the expression is active
10 during the execution of the first computer program;
11 (f) an attachment expression profiler which stores the state at least one attachment
12 expression with each snapshot;
13 (g) a history stored in the memory, the history being a plurality of snapshots;
14 (h) a display unit to display the history to a user; and
15 (i) an input device by which the user can input the expression to be traced.

16 20. A profiler to record the profile of a particular expression/variable within a program executing
17 within a logical processing device, said profiler comprising:

- 18 (a) means to choose the particular expression/variable in a program executing within the
19 logical processing device;
20 (b) means to record a snapshot of the particular expression/variable whenever the
21 program addresses a memory location of the particular expression/variable without
22 interrupting the program;
23 (c) means to collect a plurality of snapshots into a profile of the particular
24 expression/variable, each snapshot corresponding to each time the program addressed
25 the memory location of the particular expression/variable;
26 (d) means to display the profile of the particular expression/variable.

1 21. The profiler of claim 20, further comprising:

- 2 (a) means to set at least one attachment expression active within the program;
- 3 (b) means to record the state of the at least one attachment expression whenever a
- 4 snapshot of the particular expression/variable is taken;
- 5 (c) means to attach each state of the at least one attachment expression to the snapshot
- 6 of the particular expression/variable when taken; and
- 7 (d) means to display the profile of the at least one attachment expression to a user.

1 22. The profiler of claim 20, further comprising;

- 2 (a) means to delete the profile.

1 23. The profiler of claim 20, further comprising:

- 2 (a) means to change the particular expression/variable.

1 24. The profiler of claim 21, further comprising:

- 2 (a) means to change the at least one attachment expression.

1 25. An article of manufacture, comprising a data storage medium tangibly embodying a program
2 of machine readable instructions executable by an electronic processing apparatus to perform
3 method steps for operating an electronic processing apparatus, said method steps comprising
4 the steps of:

- 5 (a) initiating a user interface to exchange data input/output with a user and an electronic
6 processing apparatus;
- 7 (b) requesting a trigger expression from a user;
- 8 (c) requesting a program identification of a program in which the trigger expression is
9 to be traced;
- 10 (d) causing the electronic processing apparatus to execute the identified program;
- 11 (e) storing the state of the trigger expression each time a memory operation occurs to the
12 trigger expression during the executing identified program without interrupting or
13 otherwise stopping execution of the identified program as a snapshot;
- 14 (f) maintaining the capability to restore each snapshot and display each snapshot to the
15 user.

16 26. The article of manufacture of claim 25, further comprising:

- 17 (a) requesting the user to assign conditions to the trigger expression whereupon when the
18 conditions are satisfied, a snapshot of the trigger expression is stored.

19 27. The article of manufacture of claim 25, further comprising:

- 20 (a) requesting the user to indicate attached expression whose states are also stored in a
21 corresponding snapshot whenever a snapshot is stored for the trigger expression.